

Study of Sub-hadronic Degrees of Freedom at RHIC

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Models of hadron formation by coalescence or recombination of constituent quarks successfully describe particle-type dependencies in the intermediate p_T region ($1.5 < p_T < 5$ GeV/c) [1, 2]. These models predict that at intermediate p_T , the azimuthal anisotropy of the yields characterized by v_2 will follow a number-of-constituent quark (n) scaling with v_2/n versus p_T/n for all hadrons falling on a universal curve. When hadron formation is dominated by coalescence, this universal curve represents the momentum-space anisotropy developed prior to hadron formation—when constituent quarks made up the relevant degrees-of-freedom.

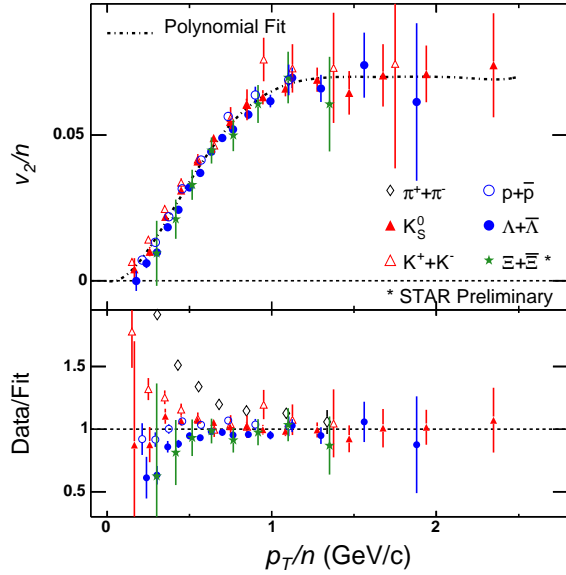


FIG. 1: Top panel: Identified particle v_2 from a minimum-bias centrality interval [1]. The vertical axis and horizontal axis have been scaled by the number of constituent quarks (n). A polynomial curve is fit to v_2 of all particles except pions. Bottom panel: The ratio of v_2 to the universal curve.

Fig. 1 (top panel) shows v_2 versus p_T for identified particles [1], where v_2 and p_T have been scaled by the number of constituent quarks. A polynomial function has been fit to the scaled values of v_2 for all particles except pions. To investigate the quality of agreement between particle species, the data from the top panel are scaled by the fitted polynomial function and plotted in the bottom panel of Fig. 1. For $p_T/n > 0.6$ GeV/c, the scaled v_2 of K_S^0 , K^\pm , $p+\bar{p}$, $\Lambda+\bar{\Lambda}$, and $\Xi+\bar{\Xi}$ are found to lie on a universal curve. All but one of the measured pion points, however, are found to deviate significantly from the curve. This deviation may be caused by the contribution of pions from resonance decays to the ob-

served pion v_2 [3]. Alternatively, it may reflect the inability of a constituent-quark-coalescence model to describe the production of pions whose masses are significantly smaller than the assumed constituent-quark masses [2].

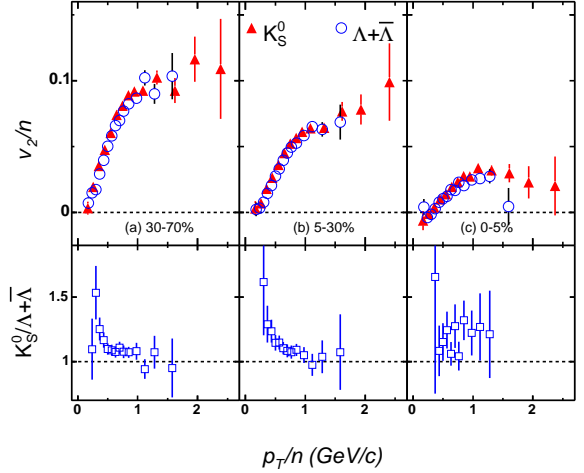


FIG. 2: Top panels: The v_2 of K_S^0 and $\Lambda+\bar{\Lambda}$ from three centrality intervals (30%–70%, 5%–30%, and 0%–5% of the collisions cross-section) scaled by the number of constituent quarks (n). The error bars represent statistical uncertainties. Bottom panels: The ratio of $K_S^0 v_2/n(p_T/n)$ to $\Lambda+\bar{\Lambda} v_2/n(p_T/n)$.

The v_2 of K_S^0 , and $\Lambda+\bar{\Lambda}$ from three centrality intervals are shown in the top panels of Fig. 2. In the bottom panels, ratios of the scaled K_S^0 and $\Lambda+\bar{\Lambda}$ v_2 values are shown. The most central data (0%–5%) are thought to be dominated by non-flow correlations. For the 30%–70% and 5%–30% centrality intervals, the v_2 of K_S^0 and $\Lambda+\bar{\Lambda}$ agrees with constituent-quark-number scaling for the expected p_T range ($p_T > 0.6$ GeV/c).

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